

## WILLIS LINN JEPSON'S "MAPPING IN FOREST BOTANY"

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### ABSTRACT

A previously unpublished manuscript written by Willis Linn Jepson in 1938 describes the preparation and value of vegetation mapping as a field exercise in a forest botany course at the University of California at Berkeley. The resultant maps, of different sites in the Oakland–Berkeley hills, not only represent an invaluable baseline for charting vegetation changes since the early 20th century, but also provided the initial impetus for A. E. Wieslander's Vegetation Type Mapping Project of California.

### INTRODUCTION

RICHARD BEIDLEMAN AND BARBARA ERTTER

Throughout his professional lifetime, botanist Willis Linn Jepson was dutiful about maintaining field books, as he called them. These pocket-sized, leather-bound diaries were used primarily for the purpose of recording the plants, often with detailed descriptions, that he encountered in his innumerable field excursions, especially throughout the state of California. But he would often include tidbits about people he met, article and books that he read, and anecdotes about other scientists, both old and new. And because he was continually thinking them up, he would write down suggestions for student projects under a heading "Subjects for Students," because he was a firm believer in "hands-on" science teaching.

Jepson's projects weren't restricted to just plant collecting, classifying, and preserving. As a result of his own field encounters, his professional interests stretched far beyond such narrow activities to involve plant physiology, genetics, evolution, ecology, and phytogeography. Because he believed in studying nature, not just books, he actually took many individual students and even entire classes out in the field. His suggested projects often involved field pursuits such as determining the most common plants in the Berkeley area, measuring the surface position of leaves of native species out-of-doors, or recording when native plants developed their flowers and leaves.

Probably the most provocative field project idea that Jepson came up with, usually for students in his botany courses, was for small teams of students to pick a natural site in the Bay Area and map in acceptable detail all of the vegetation. Frederic Clements, in his *Research Methods in Ecology* (1905) and his textbook *Plant Physiology and Ecology* (1907), described the use of quadrats and transects, and he even described "Formation Maps," the latter involving "an outline map in which the various zones, consocieties, communities, etc., are shown." But few researchers, and even fewer students, were involved in the early 20th century producing "For-

mation Maps" until Jepson actually set his teams of students to work on these projects just a few years after Clements published his ideas.

Jepson's students were becoming involved in more than mere plant listing. The mapping projects were definitely ecological in format and indirectly of greater significance and potential than even Jepson might have initially predicted. When retirement in 1937 provided Jepson with more time for reflection, he not only started going back over all of his field books and adding embellishments, but he also began writing about some of his research and teaching activities. Among these manuscripts was one that dealt with the vegetation mapping project. Because of its outstanding historic value at a time when vegetation mapping and classification is receiving much attention (e.g., Sawyer and Keeler-Wolf 1995), Jepson's manuscript is published here for the first time.

In a sense Jepson was correct in claiming that he was responsible for initiating, through senior pre-forestry student A. Everett Wieslander, forest mapping as a widespread U.S. Forest Service program (Ertter 2001; Wieslander 1935; Wieslander et al. 1932–1945). However, there are chronological problems with the article, which Jepson wrote some 25 years after the pertinent events. Jepson initially stated that Wieslander and his classmate Frank Herbert approached him in 1912 about teaching a course in forestry for students in the College of Agriculture. This seems unlikely inasmuch as Jepson was on leave in 1912–1913. But at the end of his article Jepson wrote that the preparation of forest vegetational mapping in "its final character flowed directly from the work of my botanical laboratory back in the year 1914." Wieslander had had to take his upper division botany course from Harvey Monroe Hall because Jepson was on leave in 1912–1913. But during the next academic year Wieslander and Herbert were seniors (Class of 1914), when they reportedly got the idea of doing a timber inventory at Muir Woods and were sent by Dean Hunt over to talk to Jepson, who had returned to teaching by this time. This is unquestionably the correct academic year for the discussion

between Jepson and the two pre-forestry students about mapping at Muir Woods, and it is relevant that Jepson was in the Muir Woods area three times during January and February of 1914 (as indicated by his field notes).

In an oral history, Wieslander (1985) reflected that when he and Herbert approached Jepson about getting academic credit for a forest inventory and management project in Muir Woods National Monument, Jepson "became hysterical and he started to sob and cry like a baby," apparently because the College of Agriculture was "trying to make a forestry professor of me, and I'm a botanist." Anyone familiar with Jepson would have difficulty visualizing him in a sobbing mode, although he did have a quick temper. It is true that some 20 years earlier Jepson had been irritated when it appeared that botany would be put under the College of Agriculture. But he had always been sympathetic with forestry, both from an academic and commercial standpoint, having spent much time with lumbermen in the field during preparation of his *Trees of California* (1909) and *Silva of California* (1910), both slanted towards forestry. Jepson was furthermore an instigator, adviser, and favored lecturer for the U.C. Forestry Club, which started in 1912 (Wieslander, incidentally, was president of the club in 1913). He was instrumental in having forestry established as an academic program at the university, with the Division of Forestry becoming an entity in 1914 (Casamajor 1965). Indeed, for some time from 1911, Jepson's academic rank was Associate Professor of Dendrology. He taught many a forestry student over the years and enjoyed running into and providing help for these men when they became professionals. One could appreciate that Jepson might indeed have been a bit disgusted with two young students who wanted to do an economic forestry management plan in a national monument, which showed some immature poor judgment (as Wieslander later appreciated). Jepson's recommendation that the two young men conduct an overall woody plant mapping project at Muir Woods, with his help but without an economic focus, made sense and paved the way toward more comprehensive forest mapping and management, which would later be spearheaded by none other than Wieslander.

#### MAPPING IN FOREST BOTANY

WILLIS LINN JEPSON

(from an unpublished 1938 manuscript in the Jepson Herbarium archives; minor editing by B. Ertter)

We first survey the plot, then draw the model.  
—Shakespeare, *King Henry IV, Part 2*

*Mapping as a forest botany course exercise.* From a very early period in the history of the flowering plant work in the Department of Botany there was at intervals occasional assignment of field

mapping as part of the work in Botany. The idea was original with me. Such assignments were made to students doing independent work who expressed a wish for a field exercise of this kind. As the years ran on and the value of the work became more and more apparent, mapping was introduced into the Forest Botany course as part of the regular requirement. While field work had always been a regular part of the course, this matter of mapping natural areas was something quite new and unfamiliar.

Because new and unfamiliar, many students mistrusted on the first day of a term their ability to do any such thing, although it was in fact quite simple though requiring pains and a large amount of field observation. The students worked in pairs, sometimes in threes. Two students were thus assigned to each of various natural areas in the Berkeley Hills, sometimes in the Oakland Hills, infrequently in Marin County. Such a natural area was a small drainage unit, a gulch, a canyon, a creek basin, or a ridge. The first duty was to make on a manila sheet, 36 × 48 inches or somewhat smaller or somewhat larger, a preliminary sketch map of the area, plotting its natural boundaries, creeks, and rivulets, contour lines being drawn in by the eye. All landmarks were indicated, such as large trees, prominent rock outcrops, or knolls. If the area were a canyon, the student moved around the summit of the bounding ridge checking the position of his landmarks and the flow of the contour lines which indicated slope or elevation.

A more elaborate method was used by students who desired to take special pains. In the laboratory a large sheet of white paper was fastened to the wall; on this was projected by a lantern, enlarged as required, a section from the topographic sheet of the United States Geological Survey showing the area selected. The student then drew in on the wall-sheet the lines of his map with a pencil and afterward finished it in ink. Or, yet again, the student could make a free-hand enlargement of his area from a topographic sheet.

Having made his preliminary map, the pairs of students were now ready for detailed field work, the object being to map the plant formations (grassland, chaparral, or woodland), and after that the associations within each formation (Fig. 1). The occurrence of notable individuals were often recorded on the map, as well as various special biological features. A report upon the area, a description and discussion of the formations, and an annotated systematic list of species was prepared by the student to accompany the map.

This assignment had great training value for the following reasons:

1. The student was required to make a complete list of the woody species of his area, and he was, thus, called upon to perform an intensified bit of work.
2. In order to make a list of the species, he had to

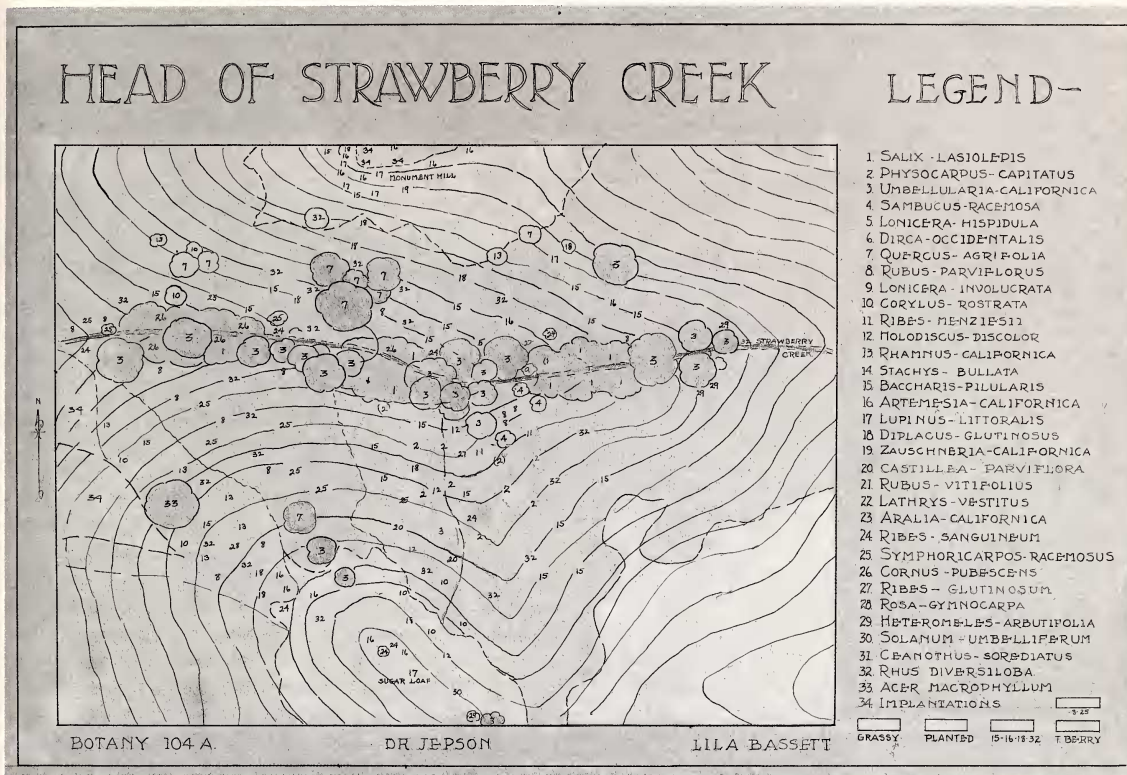


FIG. 1. Example of map produced as a field mapping exercise in Jepson's Forest Botany course: *Head of Strawberry Creek*, by Lila Bassett, undated (original in Jepson Herbarium Archives). Although this particular example lacks a date, other maps in the collection were prepared 1918–1923. Strawberry Creek is in the Oakland–Berkeley hills due east of the main campus of the University of California at Berkeley. Although still largely undeveloped, large areas have been significantly altered by the introduction and spread of non-native vegetation, including various pines, *Eucalyptus*, and French broom (*Genista monspessulana*). Some of this vegetation is marked on Bassett's map as "Implantations" (34).

learn what a species is in the field. It was necessary to compare hundreds and hundreds of individuals of a given species and make sure that the differences amongst them were immaterial and that they truly belonged to one species. All species in the area had to be tested in this way. This was a highly practical exercise in the field recognition of species.

3. For his report, the student was shown how to observe various phenomena of the plant in order to determine as much as possible of its biology and life-history. He, therefore, became thoroughly imbued with the idea of the plant as a living thing, since no plant was ever quite alike from season to season, not even from week to week.
4. The student pairs being assigned to different canyons or ridges, there was thus cultivated a spirit of independence and self-reliance.
5. The area being given to only two students, they developed in it a sense of personal pride and possession. Even after the final examination at Christmas, it was sometimes noted that students continued to study their area. When asked why

they made yet another trip to it, the reply was: "We wished to see what it is doing now." So striking and significant, therefore, were the progressive changes in the life history to the close observer.

The sets of maps drawn by the Forest Botany students have been preserved (e.g., Fig. 1). They represent a valuable record of vegetation conditions in the hills at the time they were made. When handed in by a class just before Christmas, the entire set was posted on the laboratory walls and in the corridors of the Botany Building, where each year's exhibition created much interest amongst visiting botanists, zoologists, and agriculturalists. Dr. Joseph Grinnell [Director, Museum of Vertebrate Zoology] declared these plant survey maps had significance in relation to the localized distribution of mammals and birds in the hills.

*Genesis of the Vegetation Type Mapping Project.* In 1912 two students, F. B. Herbert and A. E. Wieslander, asked that I give a course in forestry for the benefit of the students in the College of Agriculture. There was at that time no division of forestry in

that college nor in the University. I refused to give such a course; the grounds of my refusal were that I was not a forester but a botanist in the College of Letters, and that my duties as a botanist more than consumed all my time and energies. But I added that I would give them work in botany which would be of the utmost value to them in all their lives as foresters and give them a real advantage over most foresters.

So I put them at the task of making a botanical map of the Muir Woods basin on the south slope of Mount Tamalpais. Since these two students belonged to the College of Agriculture, they wished to make an economic map of the area. I replied: "No. This must be a scientific map. To include only economic species would be ineffective because species of biological importance will be omitted; non-economic species tie in ecologically with economic species. The biological associations and interrelationships must be worked out; they are of fundamental importance. Moreover, a woody species thought useless today may tomorrow be highly valued economically. An economic map is partial and temporary; a scientific map is sound in concept and of permanent value." After a good deal of discussion, the two acceded to my view and went to work with great enthusiasm on their project. The final result was one of the most important reports on a natural area ever completed by students under the direction of my laboratory.

Nor did the significance of it end here. Both men won scientific positions in the United States Department of Agriculture, Herbert in the Division of Entomology, Wieslander in the Forest Service. In the course of time, the California Forest Experiment Station was established, and Wieslander was called to its staff. A highly important project was undertaken, that of a woody (vegetation) type map of all California, showing all the important associations in colors. The project was of the greatest scientific importance. Nothing on this scale had ever been done elsewhere in the New World, perhaps not even in the Old World.

The central governmental authority at Washington, contrary to Wieslander's recommendation, decreed after its fashion and custom that the map should be an economic map. Field work was pushed forward in southern California, and very soon, under Wieslander's effective driving methods, a considerable number of quadrangles were mapped and made ready for use. Economic use of the maps

by other branches of the Forest Service, especially by the various national forests, soon developed such that in certain particulars the maps were deficient though complete as to the original economic conception. The explanation was simple. New economic aspects developed so rapidly that it was proven repeatedly that an economic map was and must be from its nature transient and insufficient.

The federal authorities were finally prevailed upon after many years to reverse their decision, and Wieslander was authorized to carry out his original plan, that of a scientific map. Moreover, he was given a considerable appropriation to re-map the quadrangles in southern California. The map now became a scientific map, that is to say a botanical type map of the woody cover, and as such not was only of importance to foresters but to California botanists and to botanists everywhere. It appears to be, in reality, the most important and comprehensive botanical map of a large area ever undertaken anywhere on the earth's surface. It is naturally a satisfaction to consider that its final character flowed directly from the work of my botanical laboratory back in the year 1914.

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